Part ii. takes into consideration the function and homologues of the areas which can be defined by the difference in cell and fibre characters. There is a vast amount of information and patient, careful work in this book, and it is impossible in a review to do more than indicate some of the principal points; but all men of science who are interested in the subject of brain structure in man and animals will be well repaid by a careful study of the work, aided by the admirably executed twenty-nine plates illustrating the cell and fibre structure of the brain and the topography of the histologically defined areas. F. W. M.

PIONEERS OF GEOLOGY.

The Founders of Geology. Second edition. By Sir Archibald Geikie, F.R.S. Pp. xi+486. (London: Macmillan and Co., Ltd., 1905.) Price 10*s.* net.

A FOUNDATION should be laid on a sound bottom, and should be itself constructed so as to hold together in one solid mass. For this, each man engaged upon it must carry out thoroughly the work entrusted to him, one in an obscure corner mixing the mortar, another, more in evidence, laying the bricks.

So in the building up of systems of knowledge we must take care that our theories are based upon those ascertained facts which we call the laws of nature, and, further, that each stage in the superstructure is consistent It is difficult to appraise exactly the value of the work of each. Many a modest and retiring worker has suggested good things which have afterwards been followed up by others; many a thoughtful student has pointed out faulty reasoning upon which vast theories were being erected.

Sir Archibald Geikie, on a former occasion, came round and selected for commendation or for criticism some of those who have been most prominent in building up the science of geology, and pointed out what was good and what might have been better done. He now inspects more in detail the work of those who laid the very foundations or prepared the ground for their reception, and gives us, first of all, a sketch of what, as we gather from very scattered notices, were the views held by the Greeks and Romans on geological questions. Then he carries us through the dark ages, in which only a small spark of intelligent observation gleamed here and there.

In order to present the speculations of the earliest writers who have referred to the subject in some definite order, our author considers them under three heads. In the Mediterranean area underground processes forced themselves upon the attention of all thoughtful and observant men, and, when we remember the story of Graham Island, which was rapidly thrown up, had the British flag hoisted upon it by Admiral Smythe, and then disappeared, it is interesting to note that Strabo and Pliny confirm the sudden appearance of islands due to ejected material. These and other ancient writers, however, could not get very far in the exploration of earthquakes and volcanoes, but referred them to wind pent up in vast cavities in the bowels of the earth.

With regard to the processes at work upon the surface of the earth, we learn that the ancient philosophers inferred that the sea now covers areas that were once dry land, and that land will appear where we now find sea, but that these phenomena escape our notice because they take place successively during periods of time, which, in comparison with our brief existence, are immensely protracted.

Herodotus calls Egypt "the gift of the Nile," while Strabo points out that deltas are prevented from advancing seawards indefinitely by the wash of the waves.

Then followed the dark ages, so far as concerned investigations into the operations of nature, until the Arabs took up the work and the learned Avicenna translated Aristotle, and expressed, even more clearly than did his Greek master, opinions regarding the origin of mountains and valleys, which show a singular forecast of modern geology.

Sir Archibald Geikie leads us on in his happy style through the later middle ages, pointing out the prejudices that hindered free inquiry, and bringing in great names, like that of Leonardo da Vinci, which we would hardly expect to find among the pioneers of geology.

Many were the shifts to which men were driven in those days in order to avoid collision with ecclesiastical authority. Some said that what looked like bones, shells, and plants in the rocks were introduced during Noah's flood; some refused to admit that they were anything but earthy concretions; and one writer went so far as to suggest that even the potsherds of Monte Testaccio at Rome were only natural productions of the earth. Some clear-headed writers tried from time to time to place scientific inquiry upon a better and more independent footing. Steno, for instance, in the seventeenth century, broke away from all preconceived ideas and prejudices, and his treatise "De Solido intra solidum naturaliter contento" marks an epoch in the history of geological investigation.

The next phase was characterised by the appearance of a number of cosmogonies, or historical sketches of the manner in which it was supposed that the crust of the earth had been built up and reached its present condition. Men's judgment was often wrested, and facts and logic strained, in the attempt to make these "theories of the earth," as they were called, consistent with orthodox ideas and with themselves, but, though they did little to advance scientific truth, they at any rate forced people to think about such things.

Buffon recognised that the earth was only part of a great planetary system, and suggested that many of the changes produced upon its surface were such as would be evolved in a mass gradually cooling down. He worked long and carefully, appealing to observation and experiment, and often getting very near a good theory, but never quite achieving it.

Sir Archibald Geikie could not, of course, in the case of the ancient writers, tell us much of their personality, their bringing up, and early associations. The description of these gives a human interest to

his account of the later writers, and enables us to realise many circumstances which coloured their scientific work.

It is interesting to learn that the majority of the more notable of those who have created the science of geology have been men engaged in other pursuits who have devoted their leisure to scientific research. Until lately there was no training in natural science such as can now be obtained at our universities and elsewhere. The nearest approach to it was the instruction given in the medical schools, and many of the best geologists have been medical men. None could, then, have been called professional geologists in the sense of having been trained specially for geological study, and but few in the sense of having made it their life's work and received pay for it, such as Sedgwick, who, having been a resident fellow of great distinction in both classics and mathematics, was appointed professor of geology, or Murchison, who, having been a soldier, was made director of the Geological Survey.

The author has recast and added to the biographical sketches of the great leaders of geology as drawn in his first edition, and has made a good book yet better. It is a work which should be in the hands of all students of geology, while the general reader cannot fail to be interested in this chapter in the history of discovery told in such charming, simple language.

ELECTROCHEMISTRY.

Experimental Electrochemistry. By N. Munroe Hopkins, Ph.D. Pp. xiv+284. (London: Archibald Constable and Co., Ltd., 1905.) Price 12*s.* net.

THE author's desire is, as he states in the preface, to produce a book which will prove useful both in the laboratory and in the lecture theatre, or, as he probably means, for home study. The book commences with a brief historical review of the subject, and the student is intended to carry out some of the classical experiments upon which the foundations of this essentially experimental branch of chemistry and physics have been built up. For example, he is instructed how to repeat Sir Humphry Davy's work on the isolation of the alkali metals. A portion of this chapter is also devoted to instructions how to manipulate the electrical supply by cutting down the current from the lighting mains with a lamp resistance, or to alter the voltage by means of a small motor generator. The author then comes to the subject of electrolytic dissociation. Dr. Hopkins is no half-hearted supporter of the ionic theory; it is evidently his sheet anchor, by which all other theories must be tested, and if they do not conform then there is evidently something lacking in these theories. It must be admitted that the author makes out a very strong case for the theory of electrolytic dissociation, and he gives experiment after experiment to prove his case. Chapter ii. deals with osmotic pressure and how to carry out the determinations; a complicated apparatus is described for experimentally proving the principle of Soret. In chapter iii. boiling- and freezing-point methods are dealt with, and experiments are described to show that chemical action will not take place except in the presence of moisture.

The next chapter treats of experiments in electrolytic induction. Some of these experiments are of an extremely interesting character, although whether opponents of the ionic theory would be prepared to admit that they are valid proofs of the theory is open to doubt. Starting with the well known fact that a negatively charged conductor will induce an opposite charge in the end of a rod brought into its neighbourhood, he describes experiments to show that the same holds good in the case of an electrolyte, and then argues that, as electricity can only pass through a liquid by means of ions, therefore the induced charge is caused by ionic movement. In the experiment of Ostwald and Nernst, where the actual liberation of hydrogen by an induced charge is made visible to the naked eye, the proof seems complete. The author, however, gives other very interesting cases where the induced charge is shown by means of a delicate mirror galvanometer, and in which no chemical change is obvious, any more than it is obvious in the case of a solid conductor. Some of the most novel experiments in this direction described by the author are those in which he shows that a magnet induces a current of electricity in an electrolyte, the magnet being placed in the centre of a glass coil containing the electrolyte.

The chapter on the velocity of electrolytic conduction is interesting, and the question of the absolute velocity of the ions is very fully dealt with. Here again the author shows his ingenuity by the number of novel experiments which he describes, and by his modification of the experiments of other workers. A large number of experiments are described to illustrate Faraday's laws, both in connection with dissolved and fused electrolytes. Dr. Hopkins also describes an experiment to illustrate the mechanical transfer of matter through solid glass. A piece of glass rod is taken with platinum wires fused into either end, the wires being about 1 cm. apart in the centre. The two wires are connected in series with a milliammeter and with the electric lighting circuit. No current, of course, passes, but on heating with a Bunsen burner until the glass commences to soften a deflection is noticed on the ammeter. With the softening of the glass, therefore, the ions are free to travel, at any rate; the glass is no longer an insulator.

The portion of the book dealing with electrolytic analysis is very short, and will be useful more as a suggestion as to what can be done than as a guide for analytical purposes. To a certain extent the same remarks apply to the electrolytic preparations which are given. The part devoted to furnace work, that is, laboratory furnace work, is pretty full. A good deal of space is given to the isolation of aluminium and also of sodium. The section devoted to calcium should be brought up to date.

An interesting account is given of the production of nitric acid from the atmosphere, with historical notes, and this chapter fails in one thing only—no